rivatives of purin—the mother substance of uric acid—and later of the proteins, thereby opening the door to almost a new branch of organic and physiological chemistry. Even in 1908, when he compiled the first set of reprints of his sugar work, he expressed the fear that this sensitiveness to phenylhydrazine would prevent him from taking any further active part in developing the chemistry of the sugars. Fortunately for posterity the old love proved too strong, and he returned again and again to the fray, the result being that forty-six additional essays chronicle the work achieved.

The writer had the good fortune to come under Fischer's tuition at the time of the opening of the new chemical laboratories in the Hessische Strasse in Berlin, and to be intimately associated with him during nearly three years, carrying out sugar inquiry under his inspiration, although at this time all other workers in the laboratory were busily engaged in the early stages of the great investigation on amino acids and proteins. Viewed from the perspective of twenty years later, it would seem that Fischer was already at that time a tired man, feeling both the strain of the work involved in obtaining and designing the new laboratory and the distraction caused by the heavy burden of official duties, which he never relished but could not avoid. Hoesch now throws much light on the events behind the scenes just before this period, as the provision of the new laboratory, made the first condition of Fischer's going from Wurzburg to Berlin, eventually took seven and a half years. His account includes the statement that at one time Fischer even seriously considered leaving Berlin and going to Bonn.

Apparently from the time he came to Berlin, as successor to Hoffmann, Fischer lived only for his work, and withdrew more and more within himself as the years passed. A widower, with his sons still young, he had no one to draw him out of himself in private life; he seemed to lose the power of unbending to his associates, although he was worshipped by his laboratory companions.

Having achieved the first synthesis of a natural sugar, glucose, Fischer's greatest ambition was to make ordinary cane sugar in the laboratory, and in 1900 this problem was again attacked with all the resources of the new laboratory. At first some measure of success was attained, as complex sugars (disaccharides) were obtained, identical or isomeric with some of the natural materials. The problem of the synthesis of cane sugar itself defied solution, however, and a measure of the difficulty of the subject is afforded by the fact that to-day, twenty years later, we are apparently no nearer success, in spite of the great progress made in other sections of carbohydrate chemistry.

The difficulties of synthesising natural and artificial glucosides were fully mastered, nearly half the papers published since 1908 dealing with this field of inquiry. These include the recognition of a third form of methylglucoside, the existence of which was concurrently demonstrated by Irvine in this country. This form, which apparently contains a γ-oxide ring, is highly active, and according to later work of Haworth, it may be the form in which the fructose molecule is present in cane sugar, for which Haworth accordingly suggested a new formula. The writer is not aware that Fischer expressed his views anywhere as to the correctness of Haworth's work; it cannot but have inspired him to renewed experimental effort to effect the much-desired synthesis.

In a dozen of the later papers are described results of the investigation of the acyl derivatives of the sugars, while a like number deal with mutations within the sugar molecule leading to the formation of substances such as glucal. The results serve to show that the chemist has still much to learn about this remarkable group; but they are too complex to be considered here.

Fischer's early work on enzymes is an acknowledged classic contribution to biological science. He returns to the subject in the last paper in this collection, dated July 14, 1919, a day before his death: this contains additional data for the discussion of the all-important question of the influence of the structure of β-glucosides on the activity of emulsin. It is written in Fischer's usual simple style—he used to dictate his papers while moving about the room in a very restless state—and shows how to the very end he retained his clarity of mind. A future generation alone can decide whether he should not be regarded as the greatest organic chemist the world has yet known.

E. F. ARMSTRONG.

American General and Economic Geology.

A Text-book of Geology. By Prof. A. W. Grabau. In two parts. Part I.: General Geology. Pp. xviii + 864. Part II.: Historical Geology. Pp. viii + 976. (London: G. G. Harrap and Co., Ltd., n.d.) 64s. net, two vols.

The Economic Aspects of Geology. By C. K. Leith. Pp. xvi + 457. (London: Constable and Co., Ltd., 1922.) 18s.

(1) PROF. AMADEUS GRABAU, who is now professor of palæontology in the University of Peking and palæontologist to the Geological Survey of China, is the author of several excellent American geological text-books, and his new "Text-book of

Geology," in two volumes—one with the sub-title "General Geology," and the other with that of "Historical Geology"—supports his reputation. His work is marked by a logical arrangement of his material and a clear and interesting statement of the main problems. His teaching has been exceptionally wide in its range, as he was first lecturer in mineralogy at Tufts College, then professor of mineralogy and geology at the Rensselaer Institute, and afterwards professor of palæontology in Columbia University, New York. He has therefore had to teach both the physical and biological sides of geology, and he writes on both with sound knowledge and judgment.

The course of study Prof. Grabau recommends is to begin with the necessary elements of chemistry and mineralogy; then pass to the igneous rocks and volcanic action; next to take the "aqueous rocks"—which he limits to those formed as chemical precipitates, excluding those due to the mechanical action of water—and the organic rocks. Then follows the examination of the processes of erosion by wind, water, and ice, and by organic agencies; and after this work has been dealt with he proceeds to their products, the clastic rocks. The materials of the earth's crust having been studied, the course proceeds to the deformation of the rocks of the earth's crust by fold and fault, and to metamorphism and the rocks made by it, and concludes with the sculpturing of the earth's surface. This scheme, according to Prof. Grabau, is unusual in America, the physiographic section of the subject being usually taken first, but though that arrangement has no doubt great advantages in secondary schools, and in the popular presentation of geology, the author's course, beginning with the primary rocks and their constituents, seems to be the most logical for advanced students, and is adopted in some British universities.

The second volume deals with historical geology, and is the section in which the author's previous work renders his opinions of most interest and weight.

One striking feature of the book is its wealth of illustrations, which in the two volumes number 1980. Some of the most original are diagrammatic sections explaining the migrations of faunas, and they show that colonies have often played an important part, though not on the lines of the hypotheses which led to this process having been so long held in well-justified distrust.

One interest of such a general text-book is its evidence as to progress towards international agreement in terminology and theory. Prof. Grabau's classification of the pre-Cambrian rocks shows that their nomenclature is still chaotic. In the names of the geological systems he regretfully uses the adjectival ending of "ian," as in Cambrian, as a concession, but he thinks the ending in "ic," such as "Cambric" will ultimately be adopted. He quotes the use of the term *caldera* for an explosion crater like Krakatoa, and uses the term *sink* for a hollow due to subsidence for which *caldera*, the Spanish word, or its English equivalent, *cauldron*, has prior right. His chapter on vulcanism is illustrated by an excellent map of its distribution, but the Cameroons volcano should not be entered as extinct. The chapter on petrology makes no use of the American system, and the author's conservative classification will probably be found generally convenient for students of the standard for which the book is intended. The view that the temperature of the centre of the earth may be 200,000° or 350,000° F. is far in excess of the more moderate temperature suggested by the probable high thermal conductivity of the barysphere.

The author discusses the cause of former glaciations, and considers that none of the theories is wholly satisfactory. He objects to the theories based on variations in composition of the atmosphere, on the ground that their effects should be world-wide, whereas the glaciations have been local. Apparently he seems most disposed towards a theory of the shifting of the poles, though recognising the weight of the mathematical objections. He gives a diagram showing how the movements of the North Pole into Greenland would explain the glaciation in North America and north-western Europe combined with the contemporary freedom of Asia from ice. As a palæontologist taking especial interest in historical geology, his views on the changes and positions of the ocean are of weight. He admits great movements of the seas, but considers that in the Palæozoic period both the Atlantic and the Pacific were shallow oceans; he represents most of the Atlantic as having been occupied by sea in the Cambrian. He discusses at some length prehistoric man, and adopts dates in years for him as if they were well established; but he is more cautious in his reference to Piltdown man than some of his co-patriots when dealing with the possibility of the skull and the jaw belonging to the same individual.

(2) Mr. C. K. Leith's book on the economic aspects of geology contains many features of special interest. The central part of the book consists of brief descriptions of the chief ores and economic minerals, of their industrial uses, geological features, and mode of formation. The terseness of the descriptions makes them all the more convenient for those who desire a synopsis of the classification and formation of the chief economic minerals. The classification places pyrites amongst the group of fertilisers. This unusual arrangement is due to pyrites being largely used for

sulphuric acid in the manufacture of superphosphate. The book discusses some general problems which are not usually dealt with in geological text-books; thus there is a chapter on the world production of minerals, the capital value of the mineral reserves, and the political and commercial control of minerals. The last chapters deal with the relation of the geologist to the exploration and development of mineral deposits, the valuation and taxation of minerals, and mining law.

The discussion on this question includes the author's opinion of the much controverted Apex Law, wherein the mining laws of the United States and Rhodesia differ from those of the rest of the world. Mr. Leith says of the American geologists and engineers that "almost to a man they favour either modification or repeal of the law"; but he recognises that as it has been in force for 50 years, so large a body of vested interests has been established under it that it would now be difficult to make serious changes in it. He remarks on the objections to the present system of the use of expert evidence in law courts and the apparent advantage of selection of experts by the Court instead of by the contending parties; but he thinks the present system on the whole preferable, as the Court might find a sound selection impossible. The intense competition in such inquiries leads to the most intensive study of the problems. The author considers that few scientific treatises on economic geology contain facts better established than the reports of the great cases that have been rendered necessary in America by the imperfections of the Apex Law.

The author's conclusions as to the conservation of mineral resources are that little is to be feared from the actual shortage of supplies, but that the difficulties will arise in their extraction and distribution at a rate adequate to meet the future demand. He explains the use of geology in the late war and discusses the international problems based on mineral resources, which he represents as now in such confusion that it will take the combined efforts of the various governments many years to bring them into order. He says the entire European coal situation is in a state of chaos, and that, "unless there is a miraculous recovery and development of Germany's coal industry, impossible conditions have been imposed."

The volume concludes with chapters on the training of the economic geologist and on the ethics of his profession. The author recommends that the intensive study of geology should be a post-graduate course, that the universities should not give degrees in economic geology, but should leave the maintenance of a high standard, both of knowledge and conduct, to the professional societies connected with geology and mining.

Our Bookshelf.

British Labour: Replacement and Conciliation 1914-21: *Being the Result of Conferences and Investigations by Committees of Section F of the British Association.* Part 1, on Replacement, Co-ordinated and Revised by Miss L. Grier and Miss A. Ashley; Part 2, on Conciliation, Edited by A. W. Kirkaldy. Pp. xxxv+266. (London: Sir Isaac Pitman and Sons, Ltd., 1921.) 10*s*. 6*d*. net.

AN attempt has been made in the volume under notice to "sum up and co-ordinate" the various reports, issued between 1915 and 1920 by the Economic Section of the British Association, and relating to problems of labour during war-time.

In the first part of the volume, Miss Grier and Miss Ashley have succeeded admirably in their rather difficult work of collation, and the result is to present in small compass a concise history of the industrial adventure of women during the period of the war. The outlines of the story are by now sufficiently familiar: the value of the present contribution lies in the rich store of material, partly statistical, which it offers, and in the conclusions it reaches regarding the future of women in industry. The moral of the story is that while war-time experience has left women more ready to offer their services in production, there has been little permanent modification of industry which would make it possible to utilise those services.

Part 2 of the volume, dealing with conciliation in British Labour, 1914-1921, is somewhat inchoate. It is practically a reprint of reports on the promotion of industrial harmony and on industrial unrest, which had already been published elsewhere, and there is little evidence of selection from the papers and speeches which make up the original reports. Some excision and co-ordination would have added to the permanent value of this section.

The last forty pages of the volume contain a sympathetic discussion of works committees by Mr. C. G. Renold, who deals, with much breadth of vision, with the problems of industrial management involved in the growth of these committees.

Royal Society. Reports of the Grain Pests (War) Committee. Nos. 1 to 10 (in 1 volume). Pp. 23+48(+11 plates)+18+20+10+51+52+28(+11 plates)+52+16. (London: Harrison and Sons, 1918–1921.)

THE Grain Pests (War) Committee was appointed by the Council of the Royal Society in June 1916, as the result of correspondence with the Board of Agriculture, in which the Board requested the Royal Society to appoint a committee "in relation to the damage done to grain by insects." When established, the committee at once took very active measures to carry out the work allotted to it, and published the results of the investigations which it initiated in a series of valuable reports. Most of the latter have already been noticed in our pages and need no further comment. These reports have now been issued in book form, together with a final brochure (Oct. 1920), drawn up by the chairman, Prof. W. A. Herdman, who has summarised the results of the researches and puts forward certain